Side Facing Seat Research

Wayne State University
TNO-Madymo

Objective

Development of neck injury criteria and injury tolerance levels to be used as a basis for a performance standard for the certification of side facing seats. The criteria and tolerance levels are intended to be used in conjunction with a Side Impact Dummy for establishment of protection performance requirements of sideways mounted aircraft seats.

Background

The FAA is faced with increasing use of sideways facing seats in aircraft. This project will focus on the use of this seat orientation in smaller (business) aircraft rather than the large commercial carriers. The injury criteria developed will be applicable for all aircraft types, however. For frontal impacts a number of criteria are known, although the list is limited: head contact by using the HIC, spine axial/vertical loading, and femur axial loading. At this time, no information is available on lateral loading of the human body in aircraft crashes. Therefore, it is required to develop injury criteria and tolerance levels specifically for side impact loading. Starting point is the impact conditions defined in the seat dynamic performance standards found in the FARs.

The injury criteria will be developed following an established procedure that involves identifying a suitable loading condition, performing tests at injury producing and non injury producing energy levels, and identifying the mechanism of neck injury and the magnitude of a biomechanical predictor (force/moment/angle) to produce that injury. This will then be mapped to a ATD or "dummy" to identify a specific dummy output (or combination there of) that can be used to determine if a particular aircraft seat configuration is suitable for occupants.

Tasks

1. Inventory and Definition.

Activities Literature review, inventory of potential injuries, design of test procedure.
Deliverables Test procedure proposal and ATD recommendation.

2. Dummy and PMHS Testing.

Activities Sled testing, followed by analysis of test data and autopsy.
Deliverables Test signals, films, and kinematics analysis data.

3. Assessment of Injury Criteria, Tolerance Level and Framework.

Activities Development of injury risk curves from PMHS testing, and neck injury tolerance values mapped from human to dummy.
Deliverables Proposal for neck injury criteria and tolerance level for lateral loading to be used as part of Standard Side Impact Test procedure.

4. Reporting

Activities Formal Documentation and Discussion of Results.
Deliverables Proposal for neck injury criteria and tolerance level. Frame work for "Standard" Side Impact Test Procedure with respect to biomechanical aspects.